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Multiplying both numerator and denominator by the above factor, bearing in mind that the denominator then becomes the whole sky, we have

$$\text{Mean altitude} = \frac{\int_0^{2\pi}\int_0^{\frac{\pi}{2}} h\cos h\,dh\,dA}{2\pi}$$

$$= \int_0^{\frac{\pi}{2}} h\cos h\,dh \qquad = \Big[h\sin h + \cos h\Big]_0^{\frac{\pi}{2}}$$

$$= \tfrac{1}{2}\pi - 1.$$

$\frac{1}{2}\pi$ in angular measure is 90°; and 1 is an arc equal to the radius.

$\therefore$ Mean altitude $= 90^\circ - 57^\circ\ 17'\ 44.8'' = 32^\circ\ 42'\ 15.2''$.

SOLUTON OF A PROBLEM.

BY PROF. C. M. WOODWARD, ST. LOUIS, MO.

To find in terms of the coordinates of a point (x',y') on one branch of the equilateral hyperbola $xy = m$, the length of a normal dropped from (x',y') upon the other branch.

Let the equation to the normal be

$$\frac{x - x'}{c} = \frac{y - y'}{s} = l$$

or $\qquad x = cl + x' \qquad$ and $y = sl + y'$.

Multiplying we have $\quad xy = l^2sc + l(x's + y'c) + x'y'$, but $xy = m$, and $x'y' = m$ for the intersections, hence $l^2sc + l(x's + y'c) = 0$.

$$l = \frac{x's + y'c}{sc} = \frac{x'}{c} + \frac{y'}{s} = x'\sec\theta + y'\operatorname{cosec}\theta.$$

(neglecting the negative sign, as that has reference only to the direction of measurement).

Now this distance must be a minimum; so put

$$\frac{dl}{d\theta} = x'\tan\theta\sec\theta - y'\cot\theta\cos\theta = 0.$$

$$\tan^3\theta = \frac{y'}{x'} \qquad \tan\theta = \frac{\sqrt[3]{y'}}{\sqrt[3]{x'}}$$

$$\sec\theta = \frac{\sqrt{(\sqrt[3]{x'^2} + \sqrt[3]{y'^2})}}{\sqrt[3]{x'}} \qquad \operatorname{cosec}\theta = \frac{\sqrt{(\sqrt[3]{x'^2} + \sqrt[3]{y'^2})}}{\sqrt[3]{y'}},$$

$$\therefore l = x'^{\frac{2}{3}}\left(x'^{\frac{2}{3}} + y'^{\frac{2}{3}}\right)^{\frac{1}{2}} + y'^{\frac{2}{3}}\left(x'^{\frac{2}{3}} + y'^{\frac{2}{3}}\right)^{\frac{1}{2}} = \left(x'^{\frac{2}{3}} + y'^{\frac{2}{3}}\right)^{\frac{3}{2}}.$$